

**EPA Superfund
Record of Decision:**

**OAK RIDGE RESERVATION (USDOE)
EPA ID: TN1890090003
OU 01
OAK RIDGE, TN
06/28/1991**

REGION IV, USEPA

6/28/91

MANAGER

DATE: 6/28/91

OAK RIDGE FIELD OFFICE, USEPA

DIRECTOR, DOE OVERSIGHT DIVISION

DATE: 6/27/91

STATE OF TENNESSEE

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

#INT

1. INTRODUCTION

THE OAK RIDGE RESERVATION (ORR) WAS PLACED ON THE NATIONAL PRIORITIES LIST (NPL) ON DECEMBER 21, 1989. THE UNITED NUCLEAR CORPORATION (UNC) DISPOSAL SITE IS ONE OF SEVERAL HUNDRED WASTE DISPOSAL SITES OR AREAS OF CONTAMINATION AT THE ORR REQUIRING REMEDIAL ACTION UNDER THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA).

IN 1989, THE US DEPARTMENT OF ENERGY (DOE) HAD PREPARED AND SUBMITTED TO THE US ENVIRONMENTAL PROTECTION AGENCY (EPA) AND THE STATE OF TENNESSEE A CLOSURE PLAN FOR THE UNC DISPOSAL SITE. IN JULY 1990, EPA ADVISED DOE THAT IT SHOULD PREPARE A FEASIBILITY STUDY (FS) TO EVALUATE SEVERAL REMEDIAL ALTERNATIVES, INCLUDING CLOSURE. EPA FURTHER ADVISED DOE THAT A SEPARATE REMEDIAL INVESTIGATION (RI) WAS NOT NECESSARY AND THAT THE REPORT PATHWAYS ANALYSIS FOR UNC DISPOSAL PIT. Y-12 PLANT COULD SERVE AS THE RI REPORT WITH MINOR SUPPLEMENTS, SUCH AS RISK ASSESSMENT AND RECENT GROUNDWATER QUALITY DATA.

#SNLD

2.0 SITE NAME, LOCATION, AND DESCRIPTION

THE UNC DISPOSAL SITE IS A 1.3-ACRE LANDFILL LOCATED NEAR THE CREST OF CHESTNUT RIDGE, IN THE SOUTHERN PORTION OF THE Y-12 PLANT, IN OAK RIDGE, TENNESSEE (FIG. 1). THE EXCAVATION FOR THE LANDFILL WAS CUT INTO THE SIDE OF CHESTNUT RIDGE. PIT DEPTHS RANGE FROM 25 TO 30 FEET ON THE NORTHERN SIDE, TO LESS THAN 5, FEET ON THE SOUTHERN SIDE. THE UNC DISPOSAL SITE CONTAINS 11,000 55-GALLON DRUMS OF CEMENT-FIXED SLUDGE, 18,000 DRUMS OF CONTAMINATED SOIL, AND 288 WOODEN BOXES OF CONTAMINATED BUILDING AND PROCESS EQUIPMENT DEMOLITION DEBRIS. THE DRUMS ARE STACKED HORIZONTALLY, 10 HIGH, IN A PYRAMID SHAPE FOLLOWING THE CONTOUR OF THE EXCAVATION. THE WOODEN BOXES ARE ON THE SOUTH SIDE OF THE STACKED DRUMS, AND THE ENTIRE WASTE SITE IS COVERED BY POLYVINYL CHLORIDE (PVC) SHEETING. OBSERVATIONS UNDER THE SHEETING INDICATE THAT MANY OF THE DRUMS AND BOXES HAVE DETERIORATED, RUSTED OR SPLIT OPEN.

#SHEA

3.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

THE UNC DISPOSAL SITE WAS ESTABLISHED TO RECEIVE WASTE FROM THE DECOMMISSIONING OF THE UNC URANIUM RECOVERY FACILITY IN WOOD RIVER JUNCTION, RHODE ISLAND. FOLLOWING SHUTDOWN OF, THE RECOVERY OPERATIONS IN 1980, UNC WAS REQUIRED TO DECONTAMINATE ITS FACILITIES, EXCAVATE CONTAMINATED SOIL AND SLUDGE FROM THE ASSOCIATED PONDS AND TRENCHES, AND REMOVE THE RESULTANT LOW-LEVEL RADIOACTIVE WASTE FROM THE STATE OF RHODE ISLAND. ONCE THE PIT WAS EXCAVATED AND PREPARED FOR RECEIPT OF WASTE, DISPOSAL OPERATIONS COMMENCED. THE UNC DISPOSAL SITE OPERATED BETWEEN JUNE 1982 AND NOVEMBER 1984. AT PRESENT THE UNC SITE IS INACTIVE AND HAS NOT RECEIVED ADDITIONAL WASTE SINCE 1984. INFORMATION AVAILABLE AT THE TIME THE WASTE WAS ACCEPTED FOR DISPOSAL INDICATED THAT IT WAS NOT A HAZARDOUS WASTE AS DEFINED BY RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) REGULATIONS. EXTRACTION PROCEDURE (EP) TOXICITY TESTING IN 1985 ON THE DRUMMED SLUDGE AND SOIL CONFIRMED THE WASTE TO BE NONHAZARDOUS UNDER RCRA. ADDITIONAL TESTING OF SOIL AND GROUNDWATER IN THE IMMEDIATE VICINITY OF THE DISPOSAL SITE INDICATES THAT MIGRATION

OF CONTAMINANTS HAD NOT OCCURRED. HOWEVER, BASED ON THE DETERIORATED CONDITION OF THE DRUMS AND THE ESTIMATED SOURCE INVENTORY AND MOBILITY OF WASTE CONSTITUENTS PRESENT, THE UNC DISPOSAL SITE WAS DEEMED A POTENTIAL RISK TO HUMAN HEALTH AND THE ENVIRONMENT.

IN DECEMBER 1989, EPA AND TENNESSEE APPROVED THE ENERGY SYSTEMS PLAN FOR CLOSURE OF THE UNC DISPOSAL SITE. HOWEVER, BEFORE THIS PLAN COULD BE IMPLEMENTED, THE ORR WAS PLACED ON THE NPL, WHICH CONSEQUENTLY REQUIRED DOE TO FOLLOW CERCLA RESPONSE ACTION PROGRAM REQUIREMENTS FOR REMEDIAL ACTION SELECTION AND IMPLEMENTATION.

#HCP

4.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

THE UNC DISPOSAL SITE FS AND PROPOSED REMEDIAL ACTION PLAN WERE RELEASED TO THE PUBLIC ON MARCH 18, 1991. THESE TWO DOCUMENTS WERE MADE AVAILABLE AT THE DOE INFORMATION REPOSITORY LOCATED IN THE FORMER RIDGE THEATER BUILDING, 105 BROADWAY, OAK RIDGE, TENNESSEE, 37831. THE NOTICE OF AVAILABILITY WAS PUBLISHED IN THE OAK RIDGER, KNOXVILLE NEWS SENTINEL, AND THE KNOXVILLE JOURNAL ON MARCH 31, APRIL 1, 2, 14, 15, 16, AND 28, 1991. NOTICES WERE ALSO PUBLISHED IN THE ROANE COUNTY N&S ON APRIL 1, 3, 5, 15, 17, AND 19, 1991. A PUBLIC COMMENT PERIOD WAS HELD FROM MARCH 18, 1991, THROUGH APRIL 30, 1991. IN ADDITION TO PUBLIC COMMENT AND THE ACCESSIBILITY OF THE INFORMATION, A PUBLIC MEETING WAS HELD ON APRIL 16, 1991. AT THIS MEETING REPRESENTATIVES OF DOE AND ENERGY SYSTEMS ANSWERED QUESTIONS AND ADDRESSED COMMUNITY CONCERNS. A RESPONSE TO COMMENTS RECEIVED DURING THIS PERIOD IS INCLUDED IN THE RESPONSIVENESS SUMMARY, APPENDIX A OF THE RECORD OF DECISION.

THIS DECISION DOCUMENT PRESENTS THE SELECTED REMEDY FOR THE UNC DISPOSAL SITE CHOSEN IN ACCORDANCE WITH CERCLA, AS AMENDED, AND TO THE EXTENT PRACTICABLE, THE NATIONAL CONTINGENCY PLAN. THE DECISION IS BASED ON THE ADMINISTRATIVE RECORD.

#SR

5.0 SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

THE MAJOR GOAL OF THIS RESPONSE ACTION IS TO PREVENT OR MINIMIZE THE CONTAMINATION OF SHALLOW GROUNDWATER BENEATH AND DOWN GRADIENT OF THE UNC DISPOSAL SITE. THIS ACTION IS CONSIDERED A FINAL ACTION WITH RESPECT TO THE UNC DISPOSAL SITE ONLY. SUBSEQUENT ACTIONS ARE PLANNED TO ADDRESS FULLY THE PRINCIPAL THREATS POSED BY THE ORR.

GROUNDWATER AT THE Y-12 PLANT IS NOT PRESENTLY USED AS A SOURCE OF DRINKING WATER AND, AS STATED PREVIOUSLY, THERE IS NO INDICATION AT PRESENT THAT GROUNDWATER UNDER THE UNC DISPOSAL SITE HAS BEEN CONTAMINATED. HOWEVER, SHALLOW GROUNDWATER AT THE Y-12 PLANT IS A POTENTIAL SOURCE OF DRINKING WATER AND ITS FUTURE USE AS A POTABLE WATER SUPPLY CANNOT BE RULED OUT. IN EVALUATING FUTURE USE SCENARIOS, IT WAS DETERMINED THAT SOURCE CONTROL ACTION WAS NECESSARY TO PREVENT FUTURE EXPOSURE TO CONTAMINANTS IN GROUNDWATER AT LEVELS THAT WOULD POSE AN UNACCEPTABLE HEALTH RISK. SPECIFICALLY, THIS ACTION IS BEING TAKEN TO ENSURE THAT MOBILE CONTAMINANTS IN THE UNC WASTE, PRINCIPALLY NITRATE AND STRONTIUM-90, ARE NOT LEACHED TO GROUNDWATER AT A RATE THAT WOULD RESULT IN CONCENTRATIONS OF THESE CONTAMINANTS ABOVE SAFE DRINKING WATER STANDARDS.

#SSC

6.0 SUMMARY OF SITE CHARACTERISTICS

6.1 DRUM AND BOX DISPOSAL AREA

THE UNC DISPOSAL SITE, IN GENERAL, REPRESENTS A SAFETY HAZARD TO WORKERS. THE 29,000 DRUMS ARE STACKED 10 HIGH, AND SOME HAVE RUSTED AND SPLIT OPEN, THEREBY EXPOSING THEIR CONTENTS. A HIGH RISK FOR INDUSTRIAL ACCIDENTS EXISTS AT THE SITE BECAUSE OF THE POTENTIAL OF SHIFTING AND

FALLING DRUMS AND EXPOSED RUSTY, SHARP METAL. THEREFORE, IN THEIR PRESENT CONDITION, THE DRUMS AND BOXES, EVEN THOUGH NONHAZARDOUS, COULD ADVERSELY AFFECT WORKERS ENTERING THE SITE.

6.2 WOODEN BOXES

THERE ARE 288 PLYWOOD BOXES LOCATED AT THE SITE. THEY ARE LOCATED IN FRONT OF THE STACKED DRUMS AND MANY HAVE SPLIT OPEN, SPILLING THEIR CONTENTS. CONTENTS OF THE BOXES VARY FROM MISCELLANEOUS INDUSTRIAL SCRAP MATERIAL (PIPING, CONVEYORS, INDUSTRIAL SCRAP, ETC.) TO SAND IN PLASTIC BAGS. A WALK-OVER RADIOLOGICAL SURVEY OF THE DRUMS AND BOXES WAS CONDUCTED IN AUGUST 1990.

6.3 DRUMMED SOILS/SLUDGES

DURING 1985, 82 SAMPLES, BASED ON A STATISTICAL PROGRAM, FROM 76 RANDOMLY SELECTED DRUMS AT THE UNC DISPOSAL SITE WERE ANALYZED BY THE RCRA EXTRACTION PROCEDURE (EP) TOXICITY LEACH TEST FOR HAZARDOUS WASTE CHARACTERIZATION. HALF OF THE SAMPLES WERE FROM DRUMS CONTAINING SOIL AND HALF OF THE SAMPLES WERE FROM DRUMS CONTAINING SLUDGES MIXED WITH CEMENT.

THE EP TOXICITY EXTRACT WAS ANALYZED FOR A WIDE RANGE OF CONSTITUENTS IN ADDITION TO THE METALS, HERBICIDES, AND PESTICIDES TYPICALLY REQUIRED IN ACCORDANCE WITH RCRA. BASED ON PROCESS KNOWLEDGE OF THE UNC DISPOSAL SITE, THE WASTES WERE ALSO TESTED FOR CORROSIVITY, NITRATES, MOISTURE CONTENT, AND RADIONUCLIDES. A SUMMARY OF THE RESULTS, IS PRESENTED IN TABLES 1 AND 2, RESPECTIVELY.

NONE OF THE SAMPLES EXCEEDED THE PH REGULATORY LIMIT FOR CORROSIVITY OF LT 2.0 OR GT 12.5. SIMILARLY, NONE OF THE EXTRACTS CONTAINED CONTAMINANT CONCENTRATIONS EXCEEDING THE REGULATORY LIMITS SET FORTH UNDER RCRA. MOST CONTAMINANT CONCENTRATIONS WERE BELOW THE DETECTION LIMITS OR LEVELS MEASURED IN BLANKS. WITH THE EXCEPTION OF STRONTIUM-90 AND NITRATE, ALL OTHER ANALYTES WERE BELOW THE SDWA MAXIMUM CONTAMINANT LEVEL (MCL) REGULATORY CRITERIA. THE CONCENTRATIONS OF NITRATES IN THE EP TOXICITY LEACHATE RANGED FROM LT 0.5 MG/L TO 8880 MG/L. THE HIGHEST CONCENTRATIONS OF NITRATES WERE FOUND IN EXTRACTS OBTAINED FROM THE SLUDGES THAT WERE MIXED WITH CEMENT. A TOTAL NITRATE (AS NITROGEN) INVENTORY FOR THE SITE WAS ESTIMATED BY ASSUMING THAT THE EXTRACTION FLUID USED IN THE EP TEST EFFECTIVELY DISSOLVED ALL OF THE LEACHABLE NITRATE IN A SPECIFIED MASS OF THE SAMPLE. A NITRATE INVENTORY OF APPROXIMATELY 53 TONS WAS CALCULATED USING THE AVAILABLE DATA AND THE REFERENCED ASSUMPTIONS. THE INVENTORY OF STRONTIUM-90 WAS ESTIMATED BY ASSUMING THE SAME AVERAGE WEIGHT AND NUMBER OF DRUMS AND USING THE AVERAGE OF 6.2 DPM/G OF STRONTIUM-90 IN THE SOLIDS. AN ESTIMATED INVENTORY OF 25 MCI OF STRONTIUM-90 WAS CALCULATED.

6.4 ADJACENT SOILS

IN 1986, SEVERAL SOIL SAMPLES WERE OBTAINED FROM THE VICINITY OF THE UNC DISPOSAL SITE AND ANALYZED FOR HEAVY METALS AND NITRATES. TWO HOLES WERE AUGURED WITHIN THE EXCAVATED PIT IMMEDIATELY DOWNGRAIENT OF THE STACKED DRUMS AND SAMPLES WERE OBTAINED FROM VARIOUS INTERVALS OVER THE 20-FT CORE DEPTHS. DATA FOR BACKGROUND SOIL CONCENTRATIONS WERE OBTAINED FROM THE UPPER 3 FEET OF SOIL AT TWO LOCATIONS EAST AND WEST OF THE DISPOSAL SITE AND FROM THE ARCHIVED CORES TAKEN DURING INSTALLATION OF A NEARBY GROUNDWATER MONITORING WELL.

THE ANALYTICAL RESULTS INDICATED THAT HEAVY METAL CONCENTRATIONS WERE HIGHER THAN BACKGROUND LEVELS TYPICAL OF SOILS DERIVED FROM LIMESTONES AND DOLOMITES. HOWEVER, ALL OF THE SAMPLES EXHIBITED SIMILAR METAL CONCENTRATIONS, AND THE HIGHER CONCENTRATIONS WERE NOT LIMITED TO THE SHALLOW SOIL DEPTHS. SOME OF THE GREATEST CONCENTRATIONS WERE OBSERVED IN SOIL SAMPLES TAKEN AT A DEPTH OF 25 FT DURING DRILLING OF WELL GW-173. WELL GW-173 IS A BACKGROUND WELL LOCATED APPROXIMATELY 1 MILE FROM THE UNC DISPOSAL SITE. THE LOW LEVELS OF NITRATES OBSERVED IN THE SAMPLES APPEAR TO INDICATE THAT THE WASTES AT THE SITE HAVE NOT LEACHED INTO THE VADOSE ZONE.

6.5 GROUNDWATER

GROUNDWATER MONITORING OF THE UNC DISPOSAL SITE HAS BEEN CONDUCTED SINCE 1986. PREVIOUS SAMPLING REPORTS CONCLUDED THAT THERE WAS NO EVIDENCE OF MIGRATION FROM THE SITE. DURING CALENDAR YEARS 1987 AND 1988, A MORE RESTRICTED SUITE OF GROUNDWATER CHEMICAL ANALYSES WAS PERFORMED WITH AN OVERALL GOAL OF DETECTING THE INITIATION OF CONTAMINANT MIGRATION. SUBSEQUENT EVALUATIONS OF THESE RESULTS PERFORMED IN 1989 CONCLUDED THAT THERE WAS NO INDICATION OF LEAKAGE FROM THE SITE. SEVEN GROUNDWATER MONITORING WELLS AT THE UNC DISPOSAL SITE (FIG.2) ARE NOW SAMPLED QUARTERLY AND ANALYZED FOR METALS, VARIOUS RADIOACTIVE SPECIES, NITRATES, AND OTHER CONVENTIONAL WATER QUALITY PARAMETERS. THE DEPTH TO GROUNDWATER, IN THE AREA, IS TYPICALLY 40 - 60 FEET, BELOW THE BASE OF THE UNC DISPOSAL SITE. THE WATER QUALITY ANALYSES OF SAMPLES COLLECTED FROM THE SEVEN UNC DISPOSAL SITE ASSESSMENT WELLS DURING 1989 AND THE FIRST QUARTER OF 1990 SHOW NO INDICATION OF LEAKAGE FROM THE SITE. DETECTABLE CONCENTRATIONS OF METALS DURING 1989 AND 1990 WERE COMMONLY BELOW APPLICABLE FEDERAL DRINKING WATER MCLS OR WITHIN RANGES OBSERVED IN BACKGROUND WELLS LOCATED ON CHESTNUT RIDGE. THE DETECTED METAL CONCENTRATIONS ARE SUPPORTED BY HISTORICAL GROUNDWATER DATA AT THE SITE AND ARE REPRESENTATIVE OF THE GROUNDWATER CHEMISTRY OF CHESTNUT RIDGE.

6.6 POTENTIAL PATHWAYS TO THE ENVIRONMENT

THE RESULTS OF SAMPLING AND ANALYSIS PROGRAMS CONDUCTED ON THE UNC WASTES INDICATED NITRATE AND STRONTIUM-90 TO BE THE ONLY CONTAMINANTS OF CONCERN. MIGRATION PATHWAYS CONSIDERED TO HAVE POTENTIAL IMPACT AND REQUIRING EVALUATION ARE SURFACE WATER AND GROUNDWATER ROUTES.

MIGRATION OF NITRATES AND STRONTIUM-90 FROM THE UNC DISPOSAL SITE VIA GROUNDWATER AND RECHARGE TO SURFACE WATER PATHWAYS WAS EVALUATED USING A WATER BALANCE COMPUTATION AND TWO-DIMENSIONAL GROUNDWATER CONTAMINANT TRANSPORT SIMULATION. THE WATER BALANCE WAS ESTIMATED USING EPA'S HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE, OR HELP MODEL. THE RESULTS OF THE HELP SIMULATIONS WERE ADJUSTED TO SUPPORT THE DATA INPUT REQUIREMENTS OF THE WMLPLUME MODEL USED TO SIMULATE CONTAMINANT TRANSPORT THROUGH GROUNDWATER. THE SIMULATIONS, PERFORMED IN 1985, WERE BASED ON THE EXISTING CONDITIONS AT THE SITE, WHICH REPRESENTED AN "UNCAPPED, EXPOSED" EXCAVATION.

REQUIRED INPUT VARIABLES INCLUDED WASTE CHARACTERISTICS AND SOIL, GEOLOGICAL, AND CLIMATOLOGICAL DATA. IN THE ABSENCE OF SPECIFIC DATA, CONSERVATIVE ASSUMPTIONS WERE MADE BASED ON CHARACTERISTICS OF THE SITE AND BOUNDARY CONDITIONS OF THE MODEL.

BASED ON THE WASTE ANALYSIS, AVAILABLE SITE-SPECIFIC DATA, AND RELEVANT CONSERVATIVE ASSUMPTIONS, THE SIMULATIONS PREDICTED THE FOLLOWING:

1. STRONTIUM-90 AND NITRATE-CONTAMINATED LEACHATE WOULD REACH THE GROUNDWATER TABLE IN APPROXIMATELY 10 YEARS.
2. APPROXIMATELY 3 YEARS BEYOND THE TIME AT WHICH THE LEACHATE REACHES THE GROUNDWATER SYSTEM, THE PLUME OF CONTAMINATION WOULD HAVE REACHED STEADY-STATE CONDITIONS. A MAXIMUM CONCENTRATION OF 193 MG/L (AS NITROGEN) FOR NITRATE AND 50 PCL/L FOR STRONTIUM-90 WAS PREDICTED.
3. THE AVERAGE CONTRIBUTION OF NITRATE (AS NITROGEN) TO THE NEAREST SURFACE TRIBUTARY WOULD RANGE FROM 10 TO 30 MG/L, DEPENDING ON THE EXTENT OF GROUNDWATER DISCHARGE TO THE STREAM (BASEFLOW).

SINCE THESE ESTIMATES ARE CONSERVATIVE, POTENTIAL CONTAMINANT CONCENTRATIONS IN GROUNDWATER AT THE SITE MAY BE LOWER.

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7.0 SUMMARY OF SITE RISKS

CERCLA DIRECTS THAT HUMAN HEALTH AND THE ENVIRONMENT MUST BE PROTECTED FROM CURRENT AND POTENTIAL EXPOSURE TO HAZARDOUS SUBSTANCES. IN ORDER TO ASSESS THE CURRENT AND POTENTIAL RISKS FOR THE UNC DISPOSAL SITE, A BASELINE RISK ASSESSMENT WAS PERFORMED BY THE RISK ANALYSIS SECTION, HEALTH AND SAFETY RESEARCH DIVISION, AT THE OAK RIDGE NATIONAL LABORATORY (ORNL), AND IS INCLUDED IN THE FEASIBILITY STUDY.

7.1 CONTAMINATED MEDIA AND CONTAMINANTS OF CONCERN

SOIL AND GROUNDWATER ANALYSIS HAS NOT IDENTIFIED ANY MIGRATION OF CONTAMINATION FROM THE UNC WASTE. THE ONLY CONTAMINATED MEDIA AT THE UNC DISPOSAL SITE ARE THE DRUMMED SOILS/SLUDGES AND MISCELLANEOUS SCRAP (SOURCE MEDIA). THE CONTAMINANTS OF CONCERN IN THE SOURCE MATERIAL ARE NITRATE AND STRONTIUM-90. NO MIGRATION TO THE SOIL OR GROUNDWATER OF THESE CONSTITUENTS HAS OCCURRED. WASTE CHARACTERIZATIONS HAVE INDICATED BOTH THESE CONSTITUENTS ARE IN HIGH CONCENTRATION AND HAVE THE GREATEST POTENTIAL TO LEACH FROM THE DRUMMED WASTES. BASED ON THEIR SOURCE INVENTORY CONCENTRATION AND ON THEIR TOXICOLOGICAL, PHYSICAL, CHEMICAL, AND ENVIRONMENTAL FATE CHARACTERISTICS, THESE CONSTITUENTS WERE DEEMED MOST LIKELY TO CONTRIBUTE TO POTENTIAL HUMAN RISK.

7.2 EXPOSURE PATHWAYS AND POPULATIONS

THE UNC DISPOSAL SITE IS SITUATED WITHIN THE LIMITED ACCESS AREA OF THE OAK RIDGE Y-12 PLANT. DIRECT ACCESS BY THE GENERAL PUBLIC IS UNLIKELY NOW, OR AT ANY TIME WITHIN THE FORESEEABLE FUTURE DUE TO THE LOCATION OF THE SITE ON THE OAK RIDGE RESERVATION (ORR). EMPLOYEES OF THE DOE FACILITIES ARE THE MOST LIKELY EXPOSED POPULATION, AND ONLY A SMALL PERCENTAGE OF THESE EMPLOYEES ARE EXPECTED TO ACCESS THE UNC DISPOSAL SITE. AFTER REMEDIAL ACTION, GROUNDWATER IS THE ONLY POTENTIAL EXPOSURE PATHWAY FOR CONTAMINANTS IN THE UNC WASTE.

MODELING WAS USED TO CONSERVATIVELY PREDICT THE EFFECT NITRATES AND STRONTIUM-90 COULD HAVE ON VARIOUS ENVIRONMENTAL MEDIA, IF THE SITE WAS LEFT IN ITS PRESENT CONDITION. MODELING IDENTIFIED A POTENTIAL IMPACT TO BOTH GROUNDWATER AND SURFACE WATER THROUGH GROUNDWATER RELEASES. GROUNDWATER IS THE ONLY EXPOSURE PATHWAY FOR CONTAMINANTS IN THE UNC WASTE.

7.3 RISK ASSESSMENT

QUANTIFICATION OF RISK FOR THE UNC WASTE IS LIMITED TO THE ADVERSE HEALTH EFFECTS OF THE TWO CONTAMINANTS OF CONCERN, NITRATE AND STRONTIUM-90. TO PROVIDE PERSPECTIVE ON THE POTENTIAL FOR NITRATE AND STRONTIUM-90 TO AFFECT HUMAN HEALTH ADVERSELY, HAZARD QUOTIENTS AND CANCER RISKS WERE DETERMINED FOR PRESENT CONDITIONS AND EACH REMEDIAL ALTERNATIVE. THE RESIDUAL RISK ASSOCIATED WITH THE UNC WASTE, IF LEFT AS IS, PROVIDES A BASELINE TO JUDGE THE REMEDIAL ALTERNATIVES. THE PATHWAYS ANALYSIS INDICATES NO CURRENT HUMAN EXPOSURE TO CONTAMINANTS AT THE UNC DISPOSAL SITE. NEVERTHELESS, AS A CONSERVATIVE MEANS OF EVALUATING THE EFFECTIVENESS OF THE REMEDIAL ALTERNATIVES, HUMAN EXPOSURE WAS ASSUMED TO OCCUR THROUGH INGESTION OF CONTAMINATED GROUNDWATER.

7.3.1 NITRATE

NITRATE IS NOT LISTED AS A HAZARDOUS CONSTITUENT BY EPA UNDER RCRA. HOWEVER, THE FEDERAL DRINKING WATER STANDARD FOR NITRATE IS 10 MG/L (AS NITROGEN). CHRONIC EXPOSURE TO NITRATES RESULTS IN METHEMOGLOBEMIA IN INFANTS LESS THAN 3 OR 4 MONTHS OLD DUE TO CONVERSION OF NITRATES TO NITRITES IN THE GASTROINTESTINAL TRACT. NITRATE HAS A GROUP D CANCER CLASSIFICATION, MEANING THERE IS NO EVIDENCE OF CARCINOGENICITY IN HUMANS OR ANIMALS. THERE HAS BEEN NO EVIDENCE OF

MUTAGENICITY RELATED TO NITRATE EXPOSURES.

7.3.2 STRONTIUM-90

EPA CLASSIFIES STRONTIUM-90 AS A GROUP A CARCINOGEN BECAUSE IONIZING RADIATION IS KNOWN TO BE CARCINOGENIC IN HUMANS AND ANIMALS. STRONTIUM IS ACQUIRED BY HUMANS PRIMARILY THROUGH INGESTING STRONTIUM-90 CONTAMINATED FOOD. IT IS RETAINED BY THE BODY LARGELY IN BONE AND MAY INHIBIT BONE CALCIFICATION. ABSORPTION OF STRONTIUM-90 BY THE BODY IS RELATIVELY HIGH, AND IT HAS A LONG BIOLOGICAL RETENTION TIME. ANIMAL STUDIES HAVE ALSO SHOWN ACUTE EFFECTS TO STRONTIUM EXPOSURE, INCLUDING RESPIRATORY FAILURES IN RATS.

7.4 RISK CHARACTERIZATION

TO EVALUATE THE NON-CARCINOGENIC EFFECTS OF NITRATE, A MEASURE OF THE POTENTIAL HEALTH RISK IS OBTAINED BY COMPARING EXPOSURE LEVELS TO THE REFERENCE DOSE (RFD). POTENTIAL NITRATE EXPOSURE LEVELS, CALCULATED FOR INGESTION OF GROUNDWATER, ARE IDENTIFIED AS MILLIGRAMS PER KILOGRAM OF BODY WEIGHT PER DAY (MG/KG/D). FOR THE CURRENT CONDITIONS REPRESENTING AN EXPOSED EXCAVATION, MODELING PREDICTED 10 YEARS FOR THE NITRATES TO REACH THE GROUNDWATER SYSTEM. AFTER 13 YEARS, A MAXIMUM NITRATE CONCENTRATION OF 193 MG/L WAS PREDICTED. THE HAZARD QUOTIENT (HQ) FOR

THE GROUNDWATER NITRATE CONCENTRATION OF 193 MG/L IS 3.4. THIS HQ IS GREATER THAN 1.0, INDICATING THAT THE NO-ACTION ALTERNATIVE MAY RESULT IN NITRATE CONCENTRATIONS THAT MAY CAUSE ADVERSE NON-CARCINOGENIC HEALTH EFFECTS. AS PREVIOUSLY STATED, HUMAN EXPOSURE IS NOT OCCURRING AND WAS ONLY ASSUMED AS A MEANS OF EVALUATING THE EFFECTIVENESS OF THE TREATMENT ALTERNATIVES.

POTENTIAL STRONTIUM-90 EXPOSURE LEVELS ARE IDENTIFIED AS PICOCURIESZ (PCI). FOR THE NO-ACTION ALTERNATIVE, MODELING PREDICTED 10 YEARS FOR STRONTIUM-90 TO REACH THE GROUNDWATER SYSTEM. THE MAXIMUM CONCENTRATION PREDICTED BY THE MODEL FOR THE DEFINED CONDITIONS WAS 50 PCI/L. RISK WAS THEN CALCULATED TO DETERMINE THE PROBABILITY OF AN INDIVIDUAL DEVELOPING CANCER OVER A LIFETIME AS A RESULT OF EXPOSURE TO THE POTENTIAL CARCINOGEN. THE RISK FOR THE NO-ACTION ALTERNATIVE IS $8.3 \times (10^{-5})$ WHICH IS WITHIN EPA'S RANGE OF CONCERN (10^{-4}) TO (10^{-6}) .

#DRAA

8.0 DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

8.1 ALTERNATIVE 1: NO ACTION

THE NCP REQUIRES THE NO-ACTION ALTERNATIVE BE CONSIDERED THROUGH THE DETAILED ALTERNATIVES ANALYSIS. IT PROVIDED A BASELINE FOR COMPARISON OF OTHER ALTERNATIVES. UNDER THIS ALTERNATIVE, NO SOURCE CONTROL REMEDIAL MEASURES WOULD BE UNDERTAKEN AT THE SITE. HOWEVER, GROUNDWATER MONITORING, SITE MONITORING AND MAINTENANCE, AND DRAINAGE MAINTENANCE AND EROSION CONTROL WOULD BE CONTINUED FOR 30 YEARS. APPROPRIATE WARNING SIGNS ALSO WOULD BE POSTED.

CONSTRUCTION COST:	\$240 ANNUAL
OPERATION AND MAINTENANCE COSTS (O&M):	
0-1 YEAR	\$ 68,000
2-30 YEAR	\$ 44,000
PRESENT WORTH (30 YR)	\$483,000
MONTHS TO IMPLEMENT	3-4

THE NO-ACTION ALTERNATIVE WOULD NOT ELIMINATE ANY EXPOSURE PATHWAYS OR REDUCE THE LEVEL OF RISKS.

8.2 ALTERNATIVE 2: MULTI-LAYER COVER

ALTERNATIVE 2 INVOLVES COVERING THE DRUMMED SOILS/SLUDGES AND MISCELLANEOUS SCRAP (BOXES) WITH A MULTI-LAYER COVER FOR LONG-TERM MINIMIZATION OF INFILTRATION. LITTLE SITE PREPARATION IS REQUIRED TO CONSTRUCT THE COVER. SOME MOVEMENT OF BARRELS AND BOXES MAY BE NECESSARY TO FACILITATE GRADING. ADDITIONAL SITE PREPARATION WITH THIS DESIGN INCLUDES ONLY MINOR GRADING AND NEGLIGIBLE CLEARING AND GRUBBING BECAUSE THE LAND SURFACE AT THE UNC DISPOSAL SITE HAS ONLY SPARSE VEGETATION. A MULTI-LAYER COVER IS COMPOSED OF A MINIMUM 24-IN-THICK CLAY LAYER OVER THE DRUMMED SOIL/SLUDGES AND MISCELLANEOUS SCRAP BOXES, OVERLAIN BY A MINIMUM 30-MIL SYNTHETIC LINER, OVERLAIN BY A POLYETHYLENE DRAINAGE GEONET, OVERLAIN BY A POLYPROPYLENE FILTER FABRIC, OVERLAIN BY A MINIMUM 18-IN-THICK VEGETATIVE LAYER. ADDITIONAL SOIL WILL BE BACKFILLED OVER UNC WASTE PRIOR TO INSTALLATION OF THE COVER. SOME VARIATIONS OF THIS DESIGN MAY BE NECESSARY TO ACCOMMODATE SITE-SPECIFIC REQUIREMENTS.

CONSTRUCTION COST:	\$ 780,500
ANNUAL O&M:	
1 YEAR:	\$ 93,600
2-30 YEARS:	\$ 69,800
PRESENT WORTH (30 YR)	\$1,467,500
MONTHS TO IMPLEMENT	8

THE TIME FRAME IN WHICH A COVER COULD BE PLACED IS RELATIVELY SHORTER THAN ALTERNATIVES THAT USE TREATMENT AS THE PRINCIPAL ELEMENT. TREATMENT RATES, DISPOSAL DISTANCES, AND IMPOSED LIMITATIONS ARE NEGLIGIBLE OR NOT APPLICABLE TO THE ALTERNATIVE.

8.3 ALTERNATIVE 3: TREATMENT AND MULTI-LAYER COVER

THIS ALTERNATIVE TREATS ONLY THE 11,000 DRUMS CONTAINING SLUDGES MIXED WITH CEMENT. THE 18,000 DRUMS OF SOIL ARE NOT TREATED BECAUSE THEY ACCOUNT FOR ONLY 1 PERCENT OF THE NITRATE AT THE SITE. MISCELLANEOUS DEMOLITION MATERIALS ARE NOT TREATED DUE TO COMPOSITIONAL VARIATIONS AND NEGLIGIBLE NITRATE CONTENT. THE ALTERNATIVE INVOLVES FOUR MAIN PROCESSING STEPS: (1) SOLID WASTE PROCESSING OF THE DRUMMED SLUDGE, (2) LEACHING OF THE NITRATE FROM THE SLUDGE, (3) TREATMENT OF THE NITRATE-BEARING LEACHATE; AND, (4) CONTAINMENT OF THE LEACHED SLUDGE, DRUMMED SOIL, AND MISCELLANEOUS BOXED SCRAP.

SOLID WASTE PROCESSING INVOLVES IDENTIFYING THE DRUMMED SLUDGES FROM THE SOILS, REMOVING THE WASTE FROM THE BARREL, REDUCING THE PARTICLE SIZE OF THE SOLID WASTE BY PRIMARY AND SECONDARY CRUSHING, SHREDDING EMPTY BARRELS, AND LEACHING NITRATES FROM THE CRUSHED SOLID WASTE. DEHEADING OF THE DRUMS AND IDENTIFYING THE CONTENTS WOULD BE PERFORMED MANUALLY. DRUMS CONTAINING SOIL WOULD BE EMPTIED AND THEIR CONTENTS COVERED WITH PVC SHEETING AND ISOLATED UNTIL COMPLETION OF THE TREATMENT PROCESS. A CONCRETE PULVERIZER WOULD REMOVE THE DRUMS SURROUNDING THE CONCRETE AND REDUCE THE CONCRETE FRAGMENTS TO LESS THAN 9 INCH DIAMETER AND THEN A SECONDARY CRUSHER WOULD CRUSH THE MATERIAL TO THE OPTIMUM PARTICLE SIZE FOR NITRATE LEACHING. A SOIL WASHING SYSTEM WOULD BE USED TO LEACH NITRATE FROM THE CRUSHED MATERIAL. WASTEWATER GENERATED FROM THE SOLID WASTE LEACHING WOULD REQUIRE TREATMENT BY NEUTRALIZATION/PH ADJUSTMENT, ANAEROBIC FIXED FILM TREATMENT, AND SEDIMENTATION. THE LEACHED CRUSHED SLUDGE, SOIL EMPTIED FROM THE DRUMS, AND MISCELLANEOUS SCRAP WOULD BE PLACED BACK IN THE EXISTING EXCAVATION AND CAPPED WITH A MULTI-LAYER COVER AS OUTLINED IN ALTERNATIVE 2. THE MISCELLANEOUS SCRAP WOULD BE REMOVED FROM THE WOODEN BOXES TO PREVENT VOID SPACES DURING FILLING. ALL BARRELS WOULD BE SHREDDED. SOIL WOULD BE REMOVED FROM THE DRUMS AND PLACED IN THE EXCAVATION, AND THE DRUMS WOULD BE SHREDDED.

CONSTRUCTION COST:	\$2,353,100
ANNUAL O&M:	
1 YEAR:	\$ 93,600
2-30 YEARS:	\$ 69,800
PRESENT WORTH (30 YR)	\$3,033,000
MONTHS TO IMPLEMENT:	25

8.4 ALTERNATIVE 4: OFF-SITE DISPOSAL

SHIPMENT AND DISPOSAL OF UNC WASTES OFF Y-12 PLANT GROUNDS IS CONSIDERED TO PROVIDE AN ALTERNATIVE INVOLVING MINIMAL LONG-TERM OVERSIGHT OR MAINTENANCE. DISPOSAL OF THE UNC WASTES OFF-SITE INVOLVES HANDLING AND PREPARING THE WASTE FOR SHIPPING TRANSPORTATION, AND DISPOSAL AT AN APPROPRIATE FACILITY. WASTE PREPARATION IS ASSUMED TO CONSIST OF HANDLING, OVERPACKING DRUMMED SOIL AND SLUDGES, AND CONTAINING MISCELLANEOUS WASTES. TRANSPORTATION WOULD BE VIA TRUCK. POTENTIAL LOW-LEVEL RADIOACTIVE CONTAMINATION GREATLY REDUCES THE NUMBER OF DISPOSAL FACILITIES THAT WILL ACCEPT THE WASTES. FOR THIS ANALYSIS IT IS ASSUMED THE WASTES WOULD BE TRANSPORTED TO US POLLUTION CONTROL'S LAND DISPOSAL FACILITY IN BEATTY, NEVADA. ONCE WASTE IS REMOVED, THE SITE WILL BE BACKFILLED WITH CLEAN SOIL AND RETURNED TO A NATURAL STATE.

CAPITAL COST:	\$13,954,000
ANNUAL O&M:	
1 YEAR:	\$ 63,000
2-3 YEARS:	\$ 39,000
PRESENT WORTH (4 YR)	\$14,073,000
MONTHS TO IMPLEMENT:	12

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9.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

THIS SECTION PROVIDES THE BASIS FOR DETERMINING WHICH ALTERNATIVE: (I) MEETS THE THRESHOLD CRITERIA OF OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT AND COMPLIANCE WITH ARARS, (II) PROVIDES THE "BEST BALANCE" BETWEEN EFFECTIVENESS AND REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT, IMPLEMENTABILITY, AND COST; AND, (III) STATE AND COMMUNITY ACCEPTANCE. A GLOSSARY OF THE EVALUATION CRITERIA IS PROVIDED IN TABLE 3.

9.1 THRESHOLD CRITERIA

9.1.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

ALTERNATIVE 1, NO ACTION, IS NOT PROTECTIVE OF HUMAN HEALTH AND ENVIRONMENT BECAUSE IT WOULD NOT ELIMINATE THE DIRECT CONTACT/EXTERNAL RADIATION EXPOSURE PATHWAY POSED BY THE BOXED MATERIALS AND WOULD LIKELY RESULT IN CONTAMINATION OF GROUNDWATER ABOVE SAFE DRINKING WATER STANDARDS. ALTERNATIVE 2, CAPPING WITH A MULTI-LAYER COVER, OFFERS THE HIGHEST DEGREE OF PROTECTION OF HUMAN HEALTH AND ENVIRONMENT BECAUSE IT REQUIRES MINIMAL WORKER EXPOSURE TO WASTES AND DISRUPTION OF THE SITE, ELIMINATES THE DIRECT CONTACT EXPOSURE PATHWAY, AND ENSURES THE FUTURE MAXIMUM NITRATE CONCENTRATION IN GROUNDWATER DOES NOT EXCEED THE SAFE DRINKING WATER STANDARD. ALTERNATIVE 3, TREATMENT AND CAPPING WITH A MULTI-LAYER COVER, AND ALTERNATIVE 4, OFF-SITE DISPOSAL, EACH PROVIDE LESS OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT THAN ALTERNATIVE 2 DUE TO SIGNIFICANT HANDLING AND PROCESSING OF THE WASTE AND POTENTIAL EXPOSURE TO THE ENVIRONMENT.

9.1.2 COMPLIANCE WITH ARARS

ALTHOUGH THERE IS NO EVIDENCE OF CONTAMINATED GROUNDWATER OR SOIL, THE POTENTIAL EXISTS (BASED ON MODELING) FOR GROUNDWATER CONTAMINATION. THEREFORE, THE SAFE DRINKING WATER ACT (SDWA) MAXIMUM CONTAMINANT LEVELS 1(MCLS) FOR NITRATE (10 MG/L) AND STRONTIUM-90 (8 PCL/L) HAVE BEEN IDENTIFIED AS A CHEMICAL-SPECIFIC ARAR'S FOR THE UNC SITE. THE NO-ACTION ALTERNATIVE WOULD NOT COMPLY WITH SDWA MCLS. THE OTHER THREE ALTERNATIVES WOULD MINIMIZE THE POTENTIAL LEACHING OF CONTAMINANTS INTO THE GROUNDWATER, THUS ENSURING COMPLIANCE WITH THE MCLS. THERE ARE NO FEDERALLY LISTED ENDANGERED OR THREATENED PLANTS OR ANIMALS AT THE SITE.

9.2 PRIMARY BALANCING CRITERIA

9.2.1 LONG-TERM EFFECTIVENESS AND PERMANENCE

HUMAN HEALTH RISKS AFTER REMEDIATION GIVE AN INDICATION OF THE LONG-TERM EFFECTIVENESS OF AN ALTERNATIVE. ALTERNATIVE 1, NO ACTION, HAS A LOW LONG-TERM EFFECTIVENESS BECAUSE OF THE POST-IMPLEMENTATION RESIDUAL RISKS ARE EQUAL TO THE LONG-TERM RISKS AT THE SITE. CAPPING WITH A MULTI-LAYER COVER, AS PROVIDED IN ALTERNATIVE 2, REDUCES THE MOBILITY OF CONTAMINANTS BUT ITS LONG-TERM EFFECTIVENESS AND PERMANENCE REQUIRES A COMMITMENT OF LONG-TERM MAINTENANCE TO ENSURE CAP INTEGRITY. ALTERNATIVE 3, TREATMENT AND CAPPING WITH A MULTI-LAYER COVER, OFFERS A HIGH DEGREE OF LONG-TERM EFFECTIVENESS AND PERMANENCE. THE TOXICITY AND VOLUME OF THE MAIN CONSTITUENT OF CONCERN, NITRATE, IS REDUCED 70 PERCENT, AND MIGRATION OF RESIDUAL MATERIAL IS REDUCED BY THE MULTI-LAYER COVER. ALTERNATIVE 4, OFF-SITE DISPOSAL, OFFERS THE HIGHEST DEGREE OF LONG-TERM EFFECTIVENESS. THE UNC WASTE WOULD BE TRANSPORTED OFF-SITE TO A TREATMENT AND DISPOSAL FACILITY. NO SOURCE MATERIAL REMAINS AT THE SITE.

9.2.2 REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

OF THE FOUR ALTERNATIVES CONSIDERED, ONLY ALTERNATIVE 3, TREATMENT OF THE DRUMMED SLUDGE AND CAPPING WITH A MULTI-LAYER COVER, REDUCES THE TOXICITY AND VOLUME OF THE NITRATE IN THE SOURCE MATERIAL. IT IS PREDICTED THAT THE TREATMENT ALTERNATIVE WOULD REDUCE THE POTENTIAL NITRATE GROUNDWATER CONCENTRATION TO 2 MG/L.

9.2.3 SHORT-TERM EFFECTIVENESS

FOR A GIVEN SET OF ALTERNATIVES, SHORT-TERM EFFECTIVENESS TYPICALLY DECREASES AS THE COMPLEXITY OF THE ALTERNATIVES INCREASE BECAUSE OF HANDLING AND PROCESSING CONSIDERATIONS. THE NO-ACTION ALTERNATIVE, ALTERNATIVE 1 PROVIDES THE GREATEST DEGREE OF PROTECTION TO WORKERS, THE PUBLIC, AND THE ENVIRONMENT BECAUSE THE DRUMMED SOIL/SLUDGES AND MISCELLANEOUS SCRAP ARE LEFT UNDISTURBED. THE SHORT-TERM EFFECTIVENESS DECREASES IN THE ALTERNATIVE IN THE FOLLOWING ORDER: 2, 4, AND 3. ALTERNATIVE 2, CAPPING WITH A MULTI-LAYER COVER, WILL REQUIRE LITTLE HANDLING OR MOVEMENT OF THE DRUMS OR BOXES. ONCE INITIAL LAYER OF FILL MATERIAL IS DEPOSITED, THE SOURCE MATERIAL WILL BE ISOLATED FROM THE WORKERS. ALTERNATIVE 4, OFF-SITE DISPOSAL, HAS A LOWER DEGREE OF SHORT-TERM EFFECTIVENESS THAN ALTERNATIVE 1 OR 2 BECAUSE IT REQUIRES HANDLING OF THE DRUMS AND MISCELLANEOUS SCRAP. HOWEVER, ONCE A DRUM IS OVERPACKED, IT IS ISOLATED FROM THE WORKER. ALTERNATIVE 3, TREATMENT AND CAPPING WITH A MULTI-LAYER COVER, HAS THE HIGHEST DEGREE OF SHORT-TERM RISK. EXTENSIVE HANDLING AND MOVEMENT OF THE DRUMS IS REQUIRED. DUST PRODUCED FROM THE CRUSHING ACTIVITIES MAY HAVE HIGH CONCENTRATIONS OF NITRATE AND RADIOACTIVE CONTAMINANTS. IT ALSO REQUIRES THE LONGEST TIME TO COMPLETE.

9.2.4 EASE OF IMPLEMENTATION

MATERIALS REQUIRED FOR THE NO-ACTION ALTERNATIVE ARE READILY AVAILABLE AND ESSENTIALLY NEGLIGIBLE. THE REMAINING ALTERNATIVES ARE ALL TECHNICALLY AND ADMINISTRATIVELY FEASIBLE. THE COVER DESIGN OF ALTERNATIVE 2 IS EASILY IMPLEMENTED. ALTERNATIVE 3 IS THE MOST DIFFICULT REMEDY TO IMPLEMENT BECAUSE OF ENGINEERING, DESIGN, AND ADMINISTRATIVE REQUIREMENTS.

ALTERNATIVE 3 COMBINES TESTED AND AVAILABLE TECHNOLOGIES TO ACHIEVE THE TREATMENT, BUT THEIR COMBINATION HAS HIGH ENGINEERING DEMANDS. ALTERNATIVE 4 HAS HIGH ADMINISTRATIVE REQUIREMENTS BECAUSE OF THE LARGE VOLUME OF MATERIAL TO BE TRANSPORTED OFF-SITE.

9.2.5 COSTS

THE COMPARATIVE ANALYSIS OF COSTS INCORPORATES ONLY DIFFERENCES IN CAPITAL, OPERATION AND MAINTENANCE, AND PRESENT WORTH VALUES. COSTS FOR EACH ALTERNATIVE HAVE BEEN PROVIDED IN SECTIONS 8.1 THROUGH 8.4. THE COSTS INCREASE WITH THE COMPLEXITY OF THE ALTERNATIVE AND THE VOLUME OF WASTE TO BE MANAGED. THE NO-ACTION ALTERNATIVE HAS THE LOWEST COSTS, WITH A 30-YEAR PRESENT WORTH OF \$483,000. ALTERNATIVE 2, EMPLACEMENT OF A MULTI-LAYER COVER, HAS A 30-YEAR PRESENT WORTH OF \$1,467,500. ALTERNATIVE 3, TREATMENT AND EMPLACEMENT OF A MULTI-LAYER COVER, HAS A 30-YEAR PRESENT WORTH OF \$3,033,000. ALTERNATIVE 4, OFF-SITE DISPOSAL IS THE HIGHEST COST ALTERNATIVE. IT HAS A 4-YEAR PRESENT WORTH OF \$14,073,000.

9.2.6 STATE ACCEPTANCE

THE STATE OF TENNESSEE, AS REPRESENTED BY THE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION, CONCURS WITH THE SELECTED ALTERNATIVE, EMPLACEMENT OF A MULTI-LAYER COVER ON THE UNC DISPOSAL SITE.

9.2.7 COMMUNITY ACCEPTANCE

BASED ON COMMENTS MADE BY CITIZENS AT THE PUBLIC MEETING HELD ON APRIL 16, 1991, DOE PERCEIVES THAT THE COMMUNITY BELIEVES THE SELECTED ACTION WILL EFFECTIVELY PROTECT HUMAN HEALTH AND THE ENVIRONMENT.

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10.0 THE SELECTED REMEDY

BASED UPON CONSIDERATION OF THE REQUIREMENTS OF CERCLA, THE DETAILED ANALYSIS OF THE ALTERNATIVES, AND PUBLIC COMMENTS, DOE HAS DETERMINED THAT THE CAPPING WITH A MULTI-LAYER COVER ALTERNATIVE IS AN APPROPRIATE REMEDIAL ACTION FOR THE UNC DISPOSAL SITE.

THE GOAL OF THE SELECTED REMEDY IS NOT TO CLEAN UP GROUNDWATER, BECAUSE GROUNDWATER IS NOT CONTAMINATED, BUT TO PREVENT FUTURE GROUNDWATER CONTAMINATION BEYOND A LEVEL DEEMED SAFE FOR DRINKING WATER. ACCORDINGLY, THE REMEDY WILL MEET THE SDWA MCL FOR NITRATE OF 10 MG/L AT THE DOWN GRADIENT PERIMETER MONITORING WELLS. THE CARCINOGEN RISK LEVEL ASSOCIATED WITH INGESTION OF GROUNDWATER CONTAINING STRONTIUM-90 COULD REACH A LEVEL OF $8.3 \times (10^{-5})$ IF NO ACTION WAS TAKEN. THE SELECTED REMEDY SHOULD ACHIEVE A CARCINOGEN RISK LEVEL OF $3.3 \times (10^{-6})$, ASSUMING GROUNDWATER AT THE UNC DISPOSAL SITE IS USED FOR DRINKING WATER IN THE FUTURE. THE REMEDIATION GOALS AS DESCRIBED HEREIN WILL BE MET AT THE DOWN GRADIENT BOUNDARY OF THE UNC DISPOSAL SITE.

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11.0 STATUTORY REQUIREMENTS

DOE, EPA, AND TDEC BELIEVE THAT THE MULTI-LAYER COVER WILL SATISFY THE STATUTORY REQUIREMENTS OF PROVIDING PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT, ATTAIN APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS DIRECTLY ASSOCIATED WITH THIS ACTION, AND WILL BE COST-EFFECTIVE. SECTIONS 11.1 THROUGH 11.6 BELOW SUMMARIZE THE STATUTORY REQUIREMENTS FOR THIS SITE.

11.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

THE SELECTED REMEDY, CAPPING WITH A MULTI-LAYER COVER, PROVIDES LONG-TERM PROTECTION OF HUMAN HEALTH AND ENVIRONMENT BECAUSE IT REDUCES THE POTENTIAL (FUTURE) RISK OF EXPOSURE TO CONTAMINATED GROUNDWATER BY MINIMIZING THE LEACHING OF CONTAMINANTS TO GROUNDWATER. WHILE THE REMEDY DOES NOT ELIMINATE ENTIRELY THE POSSIBILITY OF FUTURE GROUNDWATER DEGRADATION, THE CONCENTRATION IS NOT EXPECTED TO EXCEED 8 MG/L FOR NITRATE AND 2 PCI/L FOR STRONTIUM-90. BASED ON POTENTIAL INGESTION OF STRONTIUM-90 CONTAMINATED GROUNDWATER, THE CONSERVATIVE ESTIMATIONS OF CARCINOGENIC RISK IS WITHIN EPA'S RANGE OF CONCERN (10^{-4} TO 10^{-6}). THE REMEDY ALSO ELIMINATES DIRECT EXPOSURE TO THE WASTE AND WILL NOT CAUSE UNACCEPTABLE SHORT TERM RISKS OR CROSS MEDIAL IMPACTS.

11.2 ATTAINMENT OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

THE ONLY ARAR IDENTIFIED FOR THIS ACTION IS THE SDWA MCLS FOR NITRATE AND STRONTIUM-90. THE SELECTED REMEDY WILL COMPLY WITH THIS APPROPRIATE AND RELEVANT REQUIREMENT.

11.3 COST EFFECTIVENESS

THE 30-YEAR PRESENT WORTH COST OF CAPPING AND ASSOCIATED MAINTENANCE AND MONITORING IS \$1,467,500. TREATMENT AND CAPPING RESIDUALS WOULD COST TWICE AS MUCH AND PROVIDE A COMPARABLE LEVEL OF PROTECTION. OFF-SITE DISPOSAL WOULD COST TEN TIMES THE COST OF THE SELECTED REMEDY.

THE SELECTED REMEDY UTILIZES A DESIGN SIMILAR TO CAPS PREVIOUSLY INSTALLED AT THE Y-12 PLANT. THIS TECHNOLOGY HAS PROVEN EFFECTIVE FOR REDUCING THE MIGRATION OF VARIOUS CONTAMINANTS AT THE Y-12 PLANT: WITH PROPER MAINTENANCE, THE SELECTED REMEDY IS COST-EFFECTIVE.

11.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGY OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

THE SELECTED REMEDY DOES NOT UTILIZE TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES. IT IS A CONTAINMENT TECHNOLOGY THAT, WHEN APPLIED, WILL MINIMIZE THE POTENTIAL FOR CONTAMINANT LEACHING TO GROUNDWATER. THE CAPPING REMEDY WAS CHOSEN OVER THE ALTERNATIVE THAT FEATURED TREATMENT BECAUSE IT WILL ACHIEVE A COMPARABLE LEVEL OF PROTECTION AT A CONSIDERABLE COST SAVINGS. ALTHOUGH CONSIDERED TO OFFER LESS PERMANENCE THAN THE OFF-SITE DISPOSAL ALTERNATIVE, THE CAPPING REMEDY DOES NOT TRANSFER THE PROBLEM TO ANOTHER LOCALE AND IS SUBSTANTIALLY LOWER IN COST.

11.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

THIS REMEDY DOES NOT SATISFY THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT. INSTEAD, THIS REMEDY UTILIZES CONTAINMENT AS THE PERMANENT SOLUTION. TREATMENT OF THE PRINCIPAL THREATS OF THE SITE WAS NOT FOUND TO BE PRACTICABLE BASED ON CONSIDERATION OF COST VERSUS LEVEL OF PROTECTION PROVIDED AS COMPARED TO THE SELECTED REMEDY.

11.6 DOCUMENTATION OF SIGNIFICANT CHANGES

THE PROPOSED PLAN FOR THE UNC DISPOSAL SITE WAS RELEASED FOR PUBLIC COMMENT ON MARCH 18, 1991. THE PROPOSED PLAN IDENTIFIED THE MULTI-LAYER COVERUP AS THE PREFERRED ACTION REMEDY FOR THE CONSTITUENTS OF CONCERN. DOE REVIEWED ALL WRITTEN AND VERBAL COMMENTS SUBMITTED DURING THE PUBLIC COMMENT PERIOD. UPON REVIEW OF THESE COMMENTS, IT WAS DETERMINED THAT NO SIGNIFICANT CHANGES TO THE REMEDY, AS IT WAS ORIGINALLY IDENTIFIED IN THE PROPOSED PLAN, WERE NECESSARY.

TABLE 3
GLOSSARY OF EVALUATION CRITERIA

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT - ADDRESSES WHETHER OR NOT A REMEDY PROVIDES ADEQUATE PROTECTION AND DESCRIBES HOW RISKS POSED THROUGH EACH PATHWAY ARE ELIMINATED, REDUCED, OR CONTROLLED THROUGH TREATMENT ENGINEERING CONTROLS OR INSTITUTIONAL CONTROLS.

COMPLIANCE WITH ARARS - ADDRESSES WHETHER OR NOT A REMEDY WILL MEET ALL THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS OF OTHER FEDERAL AND STATE ENVIRONMENT STATUTES AND/OR PROVIDES GROUNDS FOR INVOKING A WAIVER.

LONG-TERM EFFECTIVENESS AND PERMANENCE - REFERS TO THE MAGNITUDE OF RESIDUAL RISK AND THE ABILITY OF A REMEDY TO MAINTAIN RELIABLE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT OVER TIME ONCE CLEANUP GOALS HAVE BEEN MET.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT - IS THE ANTICIPATED PERFORMANCE OF THE TREATMENT TECHNOLOGIES THAT MAY BE EMPLOYED IN A REMEDY.

SHORT-TERM EFFECTIVENESS - REFERS TO THE SPEED WITH WHICH THE REMEDY ACHIEVES PROTECTION, AS WELL AS THE REMEDY'S POTENTIAL TO CREATE ADVERSE IMPACTS ON HUMAN HEALTH AND THE ENVIRONMENT THAT MAY RESULT DURING THE CONSTRUCTION AND IMPLEMENTATION PERIOD.

IMPLEMENTABILITY - IS THE TECHNICAL AND ADMINISTRATIVE FEASIBILITY OF A REMEDY, INCLUDING THE AVAILABILITY OF MATERIALS AND SERVICES NEEDED TO IMPLEMENT THE CHOSEN SOLUTION.

COST - INCLUDES CAPITAL AND OPERATION AND MAINTENANCE COSTS.

STATE ACCEPTANCE - INDICATES WHETHER THE STATE CONCURS WITH, OPPOSES, OR HAS NO COMMENT ON THE PROPOSED PLAN.

COMMUNITY ACCEPTANCE - THE RESPONSIVENESS SUMMARY IN THE APPENDIX OF THE RECORD OF DECISION REVIEWS THE PUBLIC COMMENTS RECEIVED FROM THE PROPOSED PLAN PUBLIC MEETING.